

Study of RANS simulation of ABL flow over complex terrains - comparison with LIDAR monitoring at Xiao-Ping-Ding

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Taipei metropolitan area is geographically located in Taipei Basin and its surrounding mountainous region can stretch to dozens of kilometers far from the basin center. Such complex terrain affects significantly the flow field; therefore, the wind speed profile should be carefully reconsidered. To this aim, the influence of the wide range of complex terrain was examined in this study. Due to the topographical effect and the limitation of wind tunnel scale, CFD is a better alternative to have a full-scale simulation of the wide range of complex terrain.

In this study, the mean flow over a complex terrain was simulated and the simulation result was compared with the results from the full scale monitoring. The CFD software FLUENT with Reynolds-averaged Navier-Stokes (RANS) equations and realizable $k-\epsilon$ turbulence model are used to simulate the flow field. A LIDAR facility was installed in-site at Xiao-Ping-Ding, which is located in the northern Taipei metropolitan area with 375 m above the sea-level. The elevation range of the LIDAR is between 10 - 400 m above ground level. The simulation domain is 26 km x 20 km x 5 km covering the eastern and northern coasts to ensure that the east-north wind profile of inflow can be given reasonably. To obtain a relatively steady wind speed data, the LIDAR data was calibrated by the recorded wind speed of several weather stations of Taiwan Central Weather Bureau. The simulation results show that the wind speed profile at the site has a good agreement with the LIDAR monitoring. It is worthy to further attempt to modify the wind profiles over the complex terrain by RANS simulation.